INTERNATIONAL STANDARD

**ISO 13939**

Second edition
2019-07

# Foil bearings — Performance testing of foil journal bearings — Testing of static load capacity, friction coefficient and lifetime

*Paliers-feuilles — Essais de performance des paliers radiaux à feuilles non lubrifiés — Essais de la capacité de charge statique, du coefficient de frottement et de la durée de vie*

Reference number
ISO 13939:2019(E)

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Published in Switzerland



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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 123, *Plain bearings*, Subcommittee SC 7, *Special types of plain bearings*.

This second edition cancels and replaces the first edition (ISO 13939:2012), which has been technically revised. The main changes compared to the previous edition are as follows:

— The content of Scope has been changed to a clearer expression.

— Table 1, Table 2, all figures and all formulae have been reviewed.

— The wording of definitions has been reviewed for consistency with ISO rules.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.


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# Foil bearings — Performance testing of foil journal bearings — Testing of static load capacity, friction coefficient and lifetime

## 1 Scope

This document describes a method for comparing the performance test results of foil journal bearings, which are lubricated by air (gas) and supported by the gas-dynamic force generated via the rotations of the rotating shaft. The test procedure proposed in this document aims to predict and evaluate the static load capacity, friction coefficient and lifetime of foil journal bearings and compare the results of these parameters under different test conditions, i.e. at varying dimensions of foil bearing, rotational speed of a shaft, pressure and humidity of the surroundings. The magnitude of the static load capacity can change according to the test setting, as the test conditions can be changed.

The test method described in this document has the following application coverage.

a) The criterion for evaluating the static load capacity is the steady-state condition; i.e. the method is applicable under limited operating conditions with uniform magnitude, load direction and rotational speed.

b) The evaluation procedure can be applied only if the foil journal bearing is under a uniform rotating inertia at an arbitrary rotational speed.

c) The dynamic load with time-variant magnitude and direction is not considered.

## 2 Normative references

There are no normative references in this document.

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

**3.1**
**take-off**
stage aimed to secure the distance between the rotating shaft and the top foil by developing aerodynamic pressure between them

**3.2**
**clearance**
shortest distance between the rotating shaft and the top foil when the axis of the shaft coincides with the axis of the housing

**3.3**
**bearing torque**
torque developed by rotational friction between the rotating shaft and the top foil

Note 1 to entry: The measurement of the bearing torque is described in 6.4.

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**3.4**
**load**
**load capacity**
weight that can be delivered by a bearing under steady-state conditions

**3.5**
**initial load**
*load* (3.4) exerted on the rotating system in the beginning

Note 1 to entry: The initial load should be lower than the static load capacity and the load at which the lifetime of the bearing is determined, as explained in 7.3 and 10.2.

**3.6**
**static load capacity**
maximum *load* (3.4) of a bearing in static state

Note 1 to entry: The measurement of the static load capacity is explained in 7.4.

**3.7**
**friction coefficient**
flow resistance caused by rotational friction between the rotating shaft and the top foil

Note 1 to entry: The measurement of the friction coefficient is described in Clause 9.

**3.8**
**lifetime of bearing**
total number of start–stop test cycles of the bearing until the first failure is observed

Note 1 to entry: The measurement of the lifetime of bearing is described in Clause 10.

## 4 Symbols

For the purposes of this document, the following symbols apply.

### 4.1 Basic characters — Roman alphabet

**Table 1 — Symbol — Basic characters — Roman alphabet**

| Symbol | Description | Unit |
|---|---|---|
| $C$ | Clearance | Micrometre |
| $d$ | Diameter | Millimetre |
| $e$ | Eccentricity | Micrometre |
| $F$ | Force | Newton |
| $F_w$ | Weight, load | Newton |
| $H$ | Height | Millimetre |
| $h$ | Humidity | Percentage |
| $K$ | Coefficient | Newton-minute per cubic millimetre |
| $L$ | Length | Millimetre |
| $M$ | Torque | Newton-millimetre |
| $N$ | Lifetime | Number of start–stop cycles |
| $p$ | Pressure | Newton per square millimetre |
| $R$ | Surface roughness | Micrometre |
| $r$ | Distance | Millimetre |


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